


Nutritional interventions in prison settings: a scoping review

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Background: Mounting evidence has shown that incarceration can affect the health and well-being of individuals and increase the risk of noncommunicable diseases (NCDs). Diet quality is known to be one of the main determinants of risk of NCDs, and dietary changes are the first approach used in primary care to reduce the incidence of NCDs. **Objective:** This scoping review aimed to summarize the evidence for (1) the diet quality of inmates, and (2) the effect of nutritional intervention in prison systems. In addition, we aimed to describe limitations in the current literature and to suggest potential future research areas. **Method:** A systematic search was performed in 2 databases (PubMed and Web of Science) using predefined search terms and covering the period May 2023 to June 2023. Additionally, reference lists from the retrieved studies were hand-searched to identify any additional relevant publications. The identified literature was screened based on defined search strategies, criteria, and research questions defined using the PICO (population or problem, interest, and context) framework. The review was conducted referring to the PRISMA-ScR and the PICO framework. **Results:** A total of 19 studies out of 63 initially identified records were included in this review (11 cross-sectional evaluations and 9 intervention-based studies). In almost all studies, assessment of the diet quality of menus showed the menus to be nutritionally adequate, except for having a higher-than-recommended intake of total energy, saturated fatty acids, sodium, cholesterol, and sugar. In addition, some studies reported a lower-than-recommended intake of fiber, magnesium, potassium, vitamins D, E, and A, and omega-3 fatty acids. Nutritional interventions were mainly planned in the form of workshops, seminars, and written material to deliver information on healthy dietary choices. Although no significant changes in inmates' dietary choices were observed in any of the studies, a high participation rate was detected. **Conclusion:** Inmates might require additional prevention intervention to reduce their susceptibility to cardiometabolic diseases by virtue of their isolation from community facilities. Interventions should be tailored to the characteristics of prison settings and inmates to increase adherence to nutritional recommendations.

Key words: diet composition, diet quality, inmates, noncommunicable diseases, nutritional intervention, nutritional recommendations, prison.

INTRODUCTION

Currently, more than 11 million people live in prison systems worldwide.^{1,2} In the USA, approximately 740 700 individuals are incarcerated in local and county jails, with a 16% increase in the annual rate of new admissions.³ In other countries, the growth rate varies between and within countries, but there is a steady global increase in the proportion of elderly inmates (more than 55 years) and female inmates.¹

Over the years, mounting evidence has shown that incarceration can affect the health and well-being of the individuals who are currently incarcerated, as well as those with a history of incarceration.^{4,5} Indeed, several cross-sectional studies have reported a higher risk for noncommunicable disease (NCDs), ie, cardiovascular disease (CVD),^{6,7} type 2 diabetes (T2D),^{8,9} and some types of cancers,^{10,11} in inmates as compared with the general population.

Therefore, incarceration might also represent a social problem, affecting the inmates' families and communities, in addition to being a public health concern.^{4,12} In view of this, to support healthcare equality, correctional institutions should offer the same medical services available to the general population.¹³

In addition, as advocated by the World Health Organization, there is an urgent need for strategies of primary healthcare that have the potential to reduce global health costs.¹⁴

Lifestyle modification, including education to a healthy diet and regular physical activity, represents the first approach in primary care to reduce the incidence of both CVD and T2D.^{15–17}

Lifestyle interventions in the general population without a known risk of CVD have been associated with a significant reduction in the main risk factors (blood pressure, LDL-cholesterol, and body mass index) as well as a significant reduction in fatal and nonfatal CV events.¹⁵ Similarly, longitudinal studies have demonstrated that intensive lifestyle intervention could induce a 58% reduction in T2D over 3 years, maintained at 27% reduction at the 15 years follow-up.¹⁷

In the prison systems, some evidence has indicated a positive impact of regular physical activity on inmates' health and quality of life.^{18–20} Meager evidence is currently available on the role of nutrition as a determinant of health among inmates.

Therefore, this scoping review aimed to summarize the evidence for (1) the diet quality of inmates, and (2) the effect of nutritional intervention in prison systems.

In addition, we aimed to describe limitations in the current literature and to suggest potential future research areas. This information might contribute toward the development of nutrition-based prevention strategies for NCDs in prison settings.

METHODS

A scoping review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Statement for Reporting Scoping Reviews²¹ (see [Table S1 in the Supporting Information online](#)).

A comprehensive literature search was conducted in 2 electronic databases: PubMed (US National Library of Medicine) and Web of Science (Thomson Reuters) from May 2023 to June 2023. The search strategy relied on the use of specific search terms combined with the Boolean operator “AND” (“prisoners OR inmates OR incarcerated individuals OR prison OR jail OR penitentiary” AND “diet OR dietary composition OR diet quality OR nutritional intervention OR nutritional program OR nutritional status”). The particular search strategy used for PubMed is provided in [File S1 in the Supporting Information online](#). Additionally, reference lists from the retrieved studies were hand-searched to identify any additional relevant publications. The included literature was identified and reviewed based on defined search strategies, criteria, and research questions defined using the PICO (population or problem, interest, and context) framework²² (see [Table S2 in the Supporting Information online](#)). Briefly, to be included in the review, articles had to describe the diet quality of inmates or nutritional interventions for the improvement of diet quality in prison settings in the adult population (age > 18 years).

No protocol was registered or published a priori. Records were first assessed based on titles and abstracts using Rayyan QCRI²³; each record was evaluated by 2 individuals in a blinded manner, and conflicting assessments were resolved upon discussion or assessment of the full text. Eligible full texts were read by at least 2 individuals.

RESULTS

Characteristics of reviewed studies

A total of 19 studies out of 63 initially identified records were eligible and included in this review ([Figure 1](#)), with 11 cross-sectional evaluations reporting diet quality^{24–34} and 9 intervention-based studies.^{32,35–42}

Cross-sectional evaluations were carried out in the USA (n = 8),^{24–29,31,32} Canada (n = 1),³⁰ and Australia (n = 2)^{33,34} in mixed populations (n = 8)^{24–31} or in populations of men only (n = 3).^{31–34} In regard to assessment of diet quality, most of the studies assessed menus of food offerings in prisons (n = 8),^{24–31} although 3 studies assessed individual food intake (by 24 h recall or diet history).^{31–44} Only 1 study assessed diet quality by determining plasma concentrations of markers for micronutrient intake.³³

In the intervention studies, the study populations ranged from 16 to 522 participants and were located in a number of different countries (n = 4 in the United States,^{32,35,36,41} n = 2 in Spain,^{38,39} n = 1 in Canada,³⁷ n = 1 in Israel,⁴² and n = 1 in Turkey⁴⁰). Most studies included only men (n = 5),^{32,35,36,38,40} while the numbers of studies carried out in women or mixed populations were n = 2^{37,41} and n = 2,^{39,42} respectively. The study durations ranged from 4 weeks to 1 year. In regards to the type of nutritional intervention, all studies reported on nutrition education about healthy dietary choices,^{35–42} except for 1 study focusing on the improvement of the quality of menus.³²

Cross-sectional evaluations

The key information on the study design and outcomes of the included studies is presented in [Table 1](#).^{24–34}

In almost all of the studies,^{24–31} the diet quality of the planned food provision (ie, menus) was assessed by comparison of the mean dietary composition of the food (energy, macronutrients, and micronutrients) with national nutritional recommendations. The results showed

the menus to be nutritionally adequate, except for containing a higher-than-recommended intake of total energy, saturated fatty acids, sodium, cholesterol, and sugar.

In addition, some studies reported a lower-than-recommended intake of fiber, magnesium, potassium, vitamins D, E, and A, and omega-3 fatty acids.

In regards to the food groups, the studies reported a lower-than-recommended consumption of fruit and vegetables, wholegrains, and dairy.^{26,28}

These findings were in line with the findings of the studies evaluating diet quality by the assessment of individual food intake.^{32–34} Indeed, in the study by Gould et al,³³ 148 men revealed a lower-than-recommended intake of micronutrients (vitamins A, C, and E, riboflavin, folate, potassium, and calcium). In addition, the blood sampling of participants (n = 139) indicated lower-than-recommended concentrations of retinol, vitamin C, zinc, and folate, confirming some micronutrient deficiencies. The findings of Hannan-Jones et al³⁴ confirmed a lower-than-recommended intake of vitamin D and omega-3 fatty acids, and a higher-than-recommended intake of sodium in a group of n = 276 inmates. The only study reporting lower-than-recommended energy intake (and vitamin C and B1 deficiency) was carried out among Haitian inmates, representing a more vulnerable population than those considered in other studies.³²

Nutritional intervention studies

The key information on study design and outcomes is presented in [Table 2](#).^{32,35–42}

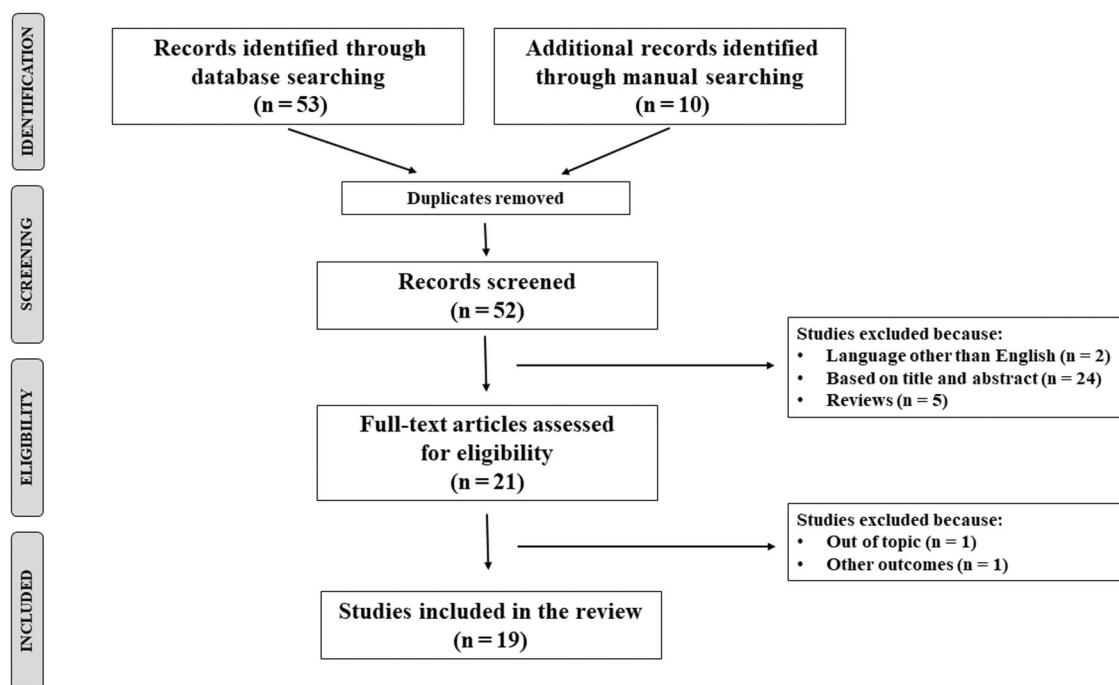


Figure 1 Flow diagram of the literature search process.

Table 1 Characteristics and main findings of cross-sectional studies that reported information on diet quality in prison settings

Reference	Country	Comparison	Outcome
Collins et al (2012) ²⁴	USA	Menu of food offerings in prisons	- High intake of cholesterol, sodium, and sugar - Low intake of fiber, magnesium, potassium, and vitamins D and E
Cook et al (2015) ²⁵	USA	Menu of food offerings in prisons	- Excessive amounts of calories, sodium, saturated fat, and cholesterol - Low intake of magnesium, potassium, and vitamins A, D, and E
Rosenboom et al (2018) ²⁶	USA	Menu of food offerings in prisons	- Low intake of fruits, vegetables, wholegrains, and dairy
Kuss et al (2021) ²⁷	USA	Menu of food offerings in prisons	High intake of sodium
Holliday et al (2021) ²⁸	USA	Menu of food offerings in prisons	- High intake of calories and sodium - Low intake of fruit and vegetables - Low levels of fiber, potassium, and vitamins D and E
Mommaerts et al (2022) ²⁹	USA	Menu of food offerings in prisons	Low levels of vitamin D (men and women), magnesium (men), and omega-3s (men)
Johnson et al (2022) ³⁰	Canada	Menu of food offerings in prisons	- High intake of sodium - Low levels of vitamin D and omega 3 s
Lopez et al (2022) ³¹	USA	Menu of food offerings in prisons	Excessive amounts of calories and saturated fat
Mainous et al (2022) ³²	USA	24 h-recall in n = 560 men Food supply assessment (prison records, ie, menu, recipes, food purchase, etc)	Low intake of total energy, and vitamins C and B1
Gould et al (2013) ³³	New Zealand	24 h-recall in n = 148 men Plasma sampling in n = 139 men	- Low intake of vitamin A, riboflavin, folate, vitamin C, vitamin E, potassium, and calcium - Low concentration of retinol, vitamin C, zinc, and folate
Hannan-Jones et al (2016) ³⁴	Australia	n = 276 men interviewed on dietary intake (diet history) Food supply assessment (prison records, ie, menu, recipes, food purchase, etc) Digital video of food preparation and consumption	- Low intake of vitamin D and omega-3 fatty acids - High intake of sodium

Clouse et al³⁵ reported the results of a 6-month educational campaign in 177 young adult men. The participants were invited to collective and individual meetings to receive information on healthy dietary choices (ie, advice to eat 5 servings per day of fruit and vegetables, increase wholegrain intake, leaner meat, and low-fat dairy). At the end of the study, only 25% of the participants showed improved dietary choices. A similar outcome was observed in the study of Curd et al³⁶ (n = 19 young adult men), in which only 23.5% of participants showed improved dietary choices.

Conversely, a study carried out in a small group of young adult women (n = 19) indicated that 57.1% of participants experienced an overall improvement in perceived health status after the nutritional education program on a healthy diet.³⁷

The 2 Spanish studies gave conflicting results, despite having similar study design and duration. In one study, after a 4-week education campaign for 33 young adult men, 51% of participants reported an

improvement in dietary choices.³⁸ In the other study, no dietary improvements were reported for a similar aged but mixed population (n = 53, 17 men and 36 women) after a 5-week nutritional program.³⁹

The study by Ors⁴⁰ was performed using a 2 × 2 factorial design intervention for 216 middle-aged men. According to the study design, the participants were assigned to receive nutritional education by an oral course, by written information (brochure), or a combination of the 2 delivery formats. The effect of the intervention was evaluated in the form of a nutrition knowledge score, obtained from questionnaire responses regarding healthy dietary choices according to nutritional recommendations. After 2 weeks, the overall group nutrition knowledge score was significantly higher in the groups receiving oral courses with or without a brochure, and the group receiving both the oral course and the brochure achieved the highest score.

In the study by Johnson et al,⁴¹ a small group of young adult women (n = 29) participated in a nutritional

Table 2 Characteristics and main findings of nutritional interventions in prison settings

Reference	Country	Study population	Intervention	Duration	Outcome
Clouse et al (2012) ³⁵	USA	n = 177 M Age: 34.8 ± 8.7 y	Collective and individual information on healthy dietary choices	6 mo	25% of individuals improved dietary choices
Curd et al (2013) ³⁶	USA	n = 19 M Age: 34 y	Three nutrition workshops on healthy dietary choices	6 mo	23.5% of individuals improved dietary choices
Elwood Martin et al (2013) ³⁷	Canada	n = 16 W Age: 18 y–40 y	Weekly nutrition seminars	6 wk	57.1% of individuals completed the education program with overall improvement of perceived health status
Martínez-Delgado et al (2016) ³⁸	Spain	n = 33 M Age: 38.2 y	Three nutrition workshops on healthy dietary choices	4 wk	51% of individuals reported improvement of dietary choices
Mauro-Martín et al (2017) ³⁹	Spain	n = 53 (17 M/36 W) Age: 34.6 ± 7.1 y	Nutrition workshops on healthy dietary choices	5 wk	No change in dietary choices
Örs (2018) ⁴⁰	Turkey	n = 216 M Age: 41 y–50 y	Nutritional education (2 h/wk) - oral course - oral course + brochure - brochure	2 wk	Nutrition knowledge score ^a was higher in the “brochure + oral course” and “oral course” group
Johnson et al (2018) ⁴¹	USA	n = 29 W Age: 42.9 ± 12 y	- control (no course or brochure) Nutritional education on MyPlate method for healthy dietary choices	12 wk	Reduction of BMI at 6 w and 12 wk compared with baseline ^b
Mainous et al (2022) ³²	USA	n = 500 M Age: 18 y–60 y	Improvement of diet composition of prisoners according to baseline evaluations of nutritional deficiencies	12 mo	Reduced prevalence of underweight individuals
Tesler et al (2023) ⁴²	Israel	n = 522 (429 M/93 W) Age: 38.2 ± 12.8 y	Nutrition seminars on a healthy diet	8 mo	13.6% attended nutrition seminar 77.96% recommended adding collective activities to promote healthy dietary choices

^aThe score was obtained from a 31-item questionnaire evaluating healthy dietary choices according to nutritional recommendations.

^bMyPlate method in combination with pedometer use (8000 steps as prescription). *Abbreviations:* BMI, body mass index; M, men; mo, months; W, women.

education program based on the “MyPlate method,” with the aim of reducing portion size and increasing diet quality. MyPlate was developed by the Harvard School of Medicine as an educational tool to guide people to consume a “healthy meal” according to the principles of the Mediterranean diet. In brief, the healthy meal was presented as a combination of slightly refined carbohydrates rich in fiber as the main source of energy, proteins of either animal origin (preferably fish, low-fat cheeses, eggs, and to a lesser extent cuts of lean meat) or vegetable origin (eg, legumes), fruit, vegetables, and extra virgin olive oil as the main condiment. After the intervention, a significant reduction in body mass index was observed, compared with baseline. Nevertheless, it is worth mentioning that the intervention also included the use of pedometers and encouragement to inmates to walk 8000 steps per day.

More recently, Mainous et al³² undertook a nutritional intervention in 500 men aged 18 years–60 years. At baseline, they performed a nutritional evaluation to determine the nutritional status and deficiencies of the participants. Accordingly, cooks working in the prison underwent an educational course on improving diet quality, to address the specific nutritional issues highlighted in the baseline assessment. After 1 year, no significant reduction in prevalence of the deficiencies was observed (in particular of vitamin C and B1). Nonetheless, the prevalence of underweight was significantly reduced after the intervention.

An 8-month educational campaign was performed in a mixed population in Israel (n = 522, 429 men and 93 women). After the intervention, only 13.6% attended nutrition seminars on a healthy diet. However, 77.96% of the study population recommended adding collective activities to promote healthy dietary choices, suggesting the need for more practical information.⁴²

DISCUSSION

A number of studies have demonstrated that inmates are a vulnerable population with increased health risk factors as compared with the general population.

Diet has been identified as one of the main determinants of individual’s health, and dietary changes can significantly improve nutritional deficiencies⁴³ as well as the onset and progression of NCDs.^{15–17,43}

Therefore, this scoping review aimed to highlight specific pitfalls in diet quality in prison settings.

The main flaws identified in the menus related to an insufficient intake of vitamins (riboflavin, and vitamins A, E, C, and D) and minerals (magnesium and potassium), likely due to the low intake of fruit and vegetables. In addition, the inadequate intake of plant-

based foods (fruit, vegetables, and wholegrains) might explain the low intake of fiber. Finally, participants frequently exceeded the recommended intake of energy, saturated fatty acids (SFAs), cholesterol, and sodium.

Therefore, the overall dietary pattern was similar to that of the general population consuming a typical Western diet, which is characterized by an insufficient intake of many critical nutrients and key foodstuffs to comply with nutritional recommendations for a healthy diet.^{15–17}

These findings are of great concern, given the mounting evidence demonstrating the detrimental effects of SFAs and sodium on human health. Indeed, a SFA-rich diet has been associated with increased inflammation and insulin resistance, which can contribute to the development of CVD and T2D.^{44–46} In addition, excessive sodium intake has been associated with hypertension,⁴⁷ which is a major risk factor for CVD.

It is worth mentioning that inmates’ dietary choices are limited by the food offerings in prison settings, by virtue of their isolation from their communities’ shopping facilities.⁴⁸ As reported in a number of the studies included in the present review, prison food service operations are often constrained by budgets that do not allow for improvement in the foods supplied. Therefore, new policies aiming to improve the diet quality of prisons’ menus are mandatory. Indeed, according to the United Nations Declaration of Human Rights, people deprived of liberty have the right to access adequate and healthy food for ensuring their health and well-being, as well as to social services for the prevention of diseases.⁴⁹

On the other hand, this scoping review aimed to investigate whether nutritional interventions might improve inmates’ dietary choices. Most of studies have been planned with workshops, seminars, and written material to deliver information on healthy dietary choices. However, studies providing a more complex intervention, including more involvement of inmates in changing their eating habits (in terms of number of educational activities and study duration), have shown a greater adherence to recommendations. Interestingly, the study by Tesler et al⁴² reported that collective activities to promote healthy dietary choices are welcomed by inmates.

Another relevant issue arising from this scoping review is related to the rate of inmate participation in the nutritional education programs. In almost all of the intervention studies, very high participation by inmates was reported.

Overall, these findings have demonstrated that education and health promotion programs could be feasible tools for increasing inmates’ adherence to nutritional recommendations. Nevertheless, interventions should be

offered through a variety of delivery strategies (eg, group-based education, printed material, and videos) so as to reach audiences with a range of literacy. In addition, the involvement of professional associations, government, researchers, and other stakeholders might help to increase the effectiveness of nutritional programs.⁵⁰

Strengths of this scoping review include the comprehensive search of the available studies, which used a wide search strategy together with a manual search of reference lists for additional records. Therefore, we can assume that all the pertinent articles were included in the screening process. However, the limited number of available studies, and the fact that they were mainly undertaken in the United States, might reduce the transferability of our findings to other populations. The data extracted from the studies allowed only qualitative interpretation of the evidence. Nevertheless, gaining accurate assessments of diet composition in prison settings are more challenging than in free-living communities. Indeed, poor literacy, limitations in the use of technological methods (due to security issues), and limitations in interaction between the interviewed individuals and the researchers represent the main issues in studies considering inmates.

CONCLUSION

Inmates might require additional prevention intervention to reduce their susceptibility to cardiometabolic diseases by virtue of their isolation from their communities' facilities. Interventions should be tailored according to the characteristics of the prison settings and the inmates to increase their adherence to nutritional recommendations.

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Declaration of interest. The authors have no relevant interests to declare.

Supporting Information

The following Supporting Information is available through the online version of this article at the publisher's website.

Table S1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) checklist

Table S2 PICO strategy

File S1 PubMed search strategy

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